3. Each square root represents the side length of the shaded square.

a) The side length of the shaded square is: $\frac{1}{2}$

So, $\sqrt{0.25} = \frac{1}{2}$, or 0.5

b) The side length of the shaded square is: $\frac{3}{4}$

So, $\sqrt{\frac{9}{16}} = \frac{3}{4}$, or 0.75

c) The side length of the shaded square is: $\frac{4}{5}$

So, $\sqrt{\frac{16}{25}} = \frac{4}{5}$, or 0.8

4. A perfect square is a number that can be written as a product of two equal factors.

The whole numbers we consider are: 1, 2, 3, …

Their squares are: $1^2 = 1$, $2^2 = 4$, $3^2 = 9$, …

a) The whole numbers from 1 to 100 that are perfect squares are:

1, 4, 9, 16, 25, 36, 49, 64, 81, 100

8. **a)** 0.12

Write 0.12 as a fraction.

$0.12 = \frac{12}{100}$ Simplify the fraction. Divide the numerator and denominator by 4.

$= \frac{3}{25}$

This fraction is in simplest form.

The denominator can be written as 5×5, but the numerator cannot be written as a product of equal factors.

So, $\frac{3}{25}$, or 0.12, is not a perfect square

b) 0.81

Write 0.81 as a fraction.

$0.81 = \frac{81}{100}$

$\frac{81}{100}$ can be written as $\frac{9}{10} \times \frac{9}{10}$.

So, $\frac{81}{100}$, or 0.81, is a perfect square.

c) 0.25

Write 0.25 as a fraction.

$0.25 = \frac{25}{100}$

$\frac{25}{100}$ can be written as $\frac{5}{10} \times \frac{5}{10}$.

So, $\frac{25}{100}$, or 0.25, is a perfect square.

d) 1.69

Write 1.69 as a fraction.

$1.69 = \frac{169}{100}$

$\frac{169}{100}$ can be written as $\frac{13}{10} \times \frac{13}{10}$.

So, $\frac{169}{100}$, or 1.69, is a perfect square.

e) $\frac{9}{12}$

Simplify the fraction first. Divide the numerator and denominator by 3.

$\frac{9}{12} = \frac{3}{4}$

The fraction is in simplest form.

Look for a fraction that, when multiplied by itself, gives $\frac{3}{4}$.

The denominator can be written as $4 = 2 \times 2$, but the numerator cannot be written as a product of equal factors. So, $\frac{9}{12}$ is not a perfect square.

f) $\frac{36}{81}$

Simplify the fraction first. Divide the numerator and denominator by 9.

$\frac{36}{81} = \frac{4}{9}$

Since $4 = 2 \times 2$ and $9 = 3 \times 3$, we can write:

$\frac{4}{9} = \frac{2}{3} \times \frac{2}{3}$

Since $\frac{4}{9}$ can be written as a product of two equal fractions, it is a perfect square.

So, $\frac{36}{81}$ is a perfect square.

g) $\frac{81}{49}$

This fraction is in simplest form. So, look for a fraction that when multiplied by itself gives $\frac{81}{49}$.

The numerator can be written as $81 = 9 \times 9$, and the denominator can be written as $49 = 7 \times 7$, so we can write:

$\frac{81}{49} = \frac{9}{7} \times \frac{9}{7}$

Since $\frac{81}{49}$ can be written as a product of two equal fractions, it is a perfect square.

So, $\frac{81}{49}$ is a perfect square.

h) $\frac{75}{27}$

Simplify the fraction first. Divide the numerator and denominator by 3.

$\frac{75}{27} = \frac{25}{9}$

Since 25 = 5 × 5, and 9 = 3 × 3, we can write:

$\frac{25}{9} = \frac{5}{3} \times \frac{5}{3}$

Since $\frac{25}{9}$ can be written as a product of two equal fractions, it is a perfect square.

So, $\frac{75}{27}$ is also a perfect square.

i) 0.081

Write 0.081 as a fraction.

$0.081 = \frac{81}{1000}$

The numerator can be written as 81 = 9 × 9, but the denominator cannot be written as a product of equal factors. So, 0.081 is not a perfect square.

j) $\frac{25}{10}$

Simplify the fraction first. Divide the numerator and denominator by 5.

$\frac{25}{10} = \frac{5}{2}$

This fraction is in simplest form.

Neither 5 nor 2 can be written as a product of equal factors, so $\frac{5}{2}$ is not a perfect square, and $\frac{25}{10}$ is not a perfect square.

k) 2.5

Write 2.5 as a fraction.

$2.5 = \frac{25}{10}$

$= \frac{5}{2}$

Neither 5 nor 2 can be written as a product of equal factors, so 2.5 is not a perfect square.

l) $\frac{8}{50}$

Simplify the fraction first. Divide the numerator and denominator by 2.

$\frac{8}{50} = \frac{4}{25}$

Since 4 = 2 × 2 and 25 = 5 × 5, we can write:

$\frac{4}{25} = \frac{2}{5} \times \frac{2}{5}$

Since $\frac{4}{25}$ can be written as a product of two equal fractions, it is a perfect square.

So, $\frac{8}{50}$ is also a perfect square.

9. a) The number whose square root is 0.3 can be represented as the area of a square with side length 0.3 units:

$0.3^2 = 0.3 \times 0.3 = 0.09$

So, 0.3 is a square root of 0.09.

b) The number whose square root is 0.12 can be represented as the area of a square with side length 0.12 units:

$0.12^2 = 0.12 \times 0.12 = 0.0144$

So, 0.12 is a square root of 0.0144.

c) The number whose square root is 1.9 can be represented as the area of a square with side length 1.9 units.

$1.9^2 = 1.9 \times 1.9 = 3.61$

So, 1.9 is a square root of 3.61.

d) The number whose square root is 3.1 can be represented as the area of a square with side length 3.1 units.

$3.1^2 = 3.1 \times 3.1 = 9.61$

So, 3.1 is a square root of 9.61.

e) $\left(\frac{2}{3}\right)^2 = \frac{2}{3} \times \frac{2}{3}$

$= \frac{4}{9}$

So, $\frac{2}{3}$ is a square root of $\frac{4}{9}$.

f) $\left(\frac{5}{6}\right)^2 = \frac{5}{6} \times \frac{5}{6}$

$= \frac{25}{36}$

So, $\frac{5}{6}$ is a square root of $\frac{25}{36}$.

g) $\left(\frac{1}{7}\right)^2 = \frac{1}{7} \times \frac{1}{7}$

$= \frac{1}{49}$

So, $\frac{1}{7}$ is a square root of $\frac{1}{49}$.

h) $\left(\frac{2}{5}\right)^2 = \frac{2}{5} \times \frac{2}{5}$

$= \frac{4}{25}$

So, $\frac{2}{5}$ is a square root of $\frac{4}{25}$.

11. a) i) $36.0 = \frac{36}{1}$

Since $36 = 6 \times 6$ and $1 = 1 \times 1$, we can write:

$\frac{36}{1} = \frac{6}{1} \times \frac{6}{1}$

Since $\frac{36}{1}$ can be written as a product of two equal fractions, it is a perfect square.

So, 36.0 is also a perfect square.

ii) $3.6 = \frac{36}{10}$ Simplify the fraction. Divide the numerator and denominator by 2.

$= \frac{18}{5}$

Since neither 18 nor 5 can be written as a product of equal factors, 3.6 is not a perfect square.

iii) $0.36 = \frac{36}{100}$ Simplify the fraction. Divide the numerator and denominator by 4.

$= \frac{9}{25}$

Since $9 = 3 \times 3$ and $25 = 5 \times 5$, we can write:

$\frac{9}{25} = \frac{3}{5} \times \frac{3}{5}$

Since $\frac{9}{25}$ can be written as a product of two equal fractions, it is a perfect square.

So, 0.36 is also a perfect square.

iv) $0.036 = \frac{36}{1000}$ Simplify the fraction. Divide the numerator and denominator by 4.

$= \frac{9}{250}$

The numerator can be written as $9 = 3 \times 3$, but the denominator cannot be written as a product of equal factors.

So, 0.036 is not a perfect square.

v) $0.0036 = \frac{36}{10\,000}$ Simplify the fraction. Divide the numerator and denominator by 4.

$= \frac{9}{2500}$

Since $9 = 3 \times 3$ and $2500 = 50 \times 50$, we can write:

$\frac{9}{2500} = \frac{3}{50} \times \frac{3}{50}$

Since $\frac{9}{2500}$ can be written as a product of two equal fractions, it is a perfect square.

So, 0.0036 is also a perfect square.

vi) $0.000\,36 = \frac{36}{100\,000}$ Simplify the fraction. Divide the numerator and denominator by 4.

$= \frac{9}{25\,000}$

The numerator can be written as $9 = 3 \times 3$, but the denominator cannot be written as a product of equal factors.

So, 0.000 36 is not a perfect square.

b) i) $\sqrt{36.0} = 6$

ii) $\sqrt{3.6} = 1.897\,366\,596\ldots$

$\doteq 1.9$

iii) $\sqrt{0.36} = 0.6$

iv) $\sqrt{0.036} = 0.189\,736\,659\,6\ldots$

$\doteq 0.19$

v) $\sqrt{0.0036} = 0.06$

vi) $\sqrt{0.000\,36} = 0.018\,973\,666\ldots$

$\doteq 0.19$

c) Answers will vary, but can include: When the denominators are 1, 100, and 10 000, the decimal is a perfect square; alternate decimals in part b are perfect squares. The decimals that are perfect squares differ by a factor of 100; the square roots of these decimals differ by a factor of 10.

d) You can use the square roots of whole numbers to determine the square roots of decimals when, if you convert the decimal to a fraction, both the numerator and denominator are perfect squares

13. a) i) $\sqrt{12.25} = \sqrt{\frac{1225}{100}}$

$= \sqrt{\frac{35}{10} \times \frac{35}{10}}$

$= \frac{35}{10}$

$= 3.5$

The square root corresponds to the letter C.

ii) $\sqrt{\frac{121}{25}} = \sqrt{\frac{11}{5} \times \frac{11}{5}}$

$= \frac{11}{5}$, or 2.2

The square root corresponds to the letter A.

iii) $\sqrt{16.81} = \sqrt{\frac{1681}{100}}$

$= \sqrt{\frac{41}{10} \times \frac{41}{10}}$

$= \frac{41}{10}$

$= 4.1$

The square root corresponds to the letter E.

iv) $\sqrt{\frac{81}{100}} = \sqrt{\frac{9}{10} \times \frac{9}{10}}$

$= \frac{9}{10}$, or 0.9

The square root corresponds to the letter B.

v) $\sqrt{0.09} = \sqrt{\frac{9}{100}}$

$= \sqrt{\frac{3}{10} \times \frac{3}{10}}$

$= \frac{3}{10}$, or 0.3

The square root corresponds to the letter F.

vi) $\sqrt{\frac{841}{25}} = \sqrt{\frac{29}{5} \times \frac{29}{5}}$

$= \frac{29}{5}$, or 5.8

The square root corresponds to the letter D.

b) Answers will vary. For example:

Let $G = \sqrt{5.76}$

$\sqrt{5.76} = \sqrt{\frac{576}{100}}$

$= \sqrt{\frac{24}{10} \times \frac{24}{10}}$

$= \frac{24}{10}$, or 2.4

Let $H = \sqrt{1.69}$

$\sqrt{1.69} = \sqrt{\frac{169}{100}}$

$= \sqrt{\frac{13}{10} \times \frac{13}{10}}$

$= \frac{13}{10}$, or 1.3

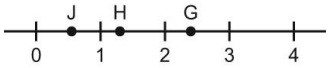
Let $J = \sqrt{0.3025}$

$\sqrt{0.3025} = \sqrt{\frac{3025}{10\,000}}$

$= \sqrt{\frac{55}{100} \times \frac{55}{100}}$

$= \frac{55}{100}$, or 0.55

The number line will appear as follows:



14. a) The side length of a square is the square root of its area.

$\sqrt{5.76} = \sqrt{\frac{576}{100}}$

$= \sqrt{\frac{24}{10} \times \frac{24}{10}}$

$= \frac{24}{10}$, or 2.4

The side length of the square is 2.4 cm.

$4 \times 2.4 = 9.6$

The perimeter of the square is 9.6 cm.

15. The side length of a square is the square root of its area.

a) Least area: 6.25 km^2

Least side length, in kilometres: $\sqrt{6.25} = 2.5$

The least possible side length is 2.5 km.

b) Greatest area: 10.24 km^2
Greatest side length, in kilometres: $\sqrt{10.24}$ = 3.2
The greatest possible side length is 3.2 km.

c) The area of the square, in square kilometres, is:
$(2.8)^2 = 7.84$

18. To determine the perfect squares between 0.64 and 0.81, take the square root of 0.64 and 0.81.

$$\sqrt{0.64} = \sqrt{\frac{64}{100}}$$
$$= \sqrt{\frac{8}{10} \times \frac{8}{10}}$$
$$= \frac{8}{10}, \text{ or } 0.8$$
$$\sqrt{0.81} = \sqrt{\frac{81}{100}}$$
$$= \sqrt{\frac{9}{10} \times \frac{9}{10}}$$
$$= \frac{9}{10}, \text{ or } 0.9$$

The squares of all numbers between 0.8 and 0.9 are between 0.64 and 0.81.
For example: $0.85^2 = 0.7225$, $0.875^2 = 0.765\,625$, and $0.89^2 = 0.7921$.
So, 0.7225, 0.765 625, and 0.7921 are all perfect squares between 0.64 and 0.81.

19. a) The area of a rectangle is its length multiplied by its width:
7.2 cm × 1.8 cm = 12.96 cm^2
So, the area of the square is also 12.96 cm^2.
Then, the side length of the square is:

$$\sqrt{12.96} = \sqrt{\frac{1296}{100}}$$
$$= \sqrt{\frac{36}{10} \times \frac{36}{10}}$$
$$= \frac{36}{10}, \text{ or } 3.6$$

The square has side length 3.6 cm.

b) Only one cut is needed. The student can cut the 7.2-cm by 1.8-cm rectangle in half lengthwise and place the two pieces together to make a square with side length 3.6 cm.